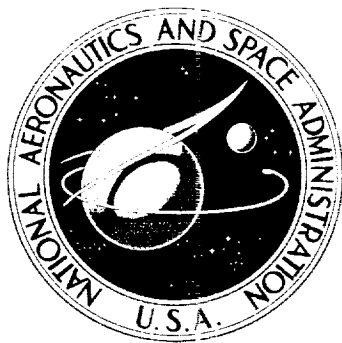


# PROGRAM STANDARDS

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Office of Manned Space Flight

**CASE FILE  
COPY**

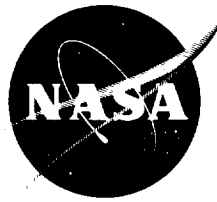


## **Reliability Program Evaluation Procedures**

**September 1963**

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
*Washington, D.C.*





## OFFICE OF MANNED SPACE FLIGHT

# RELIABILITY PROGRAM EVALUATION PROCEDURES

(R-1)

### PREFACE

Reliability Program Evaluation Procedures and related survey checklists are established as a standard to assure consistent evaluations of reliability procedures and controls being applied to Manned Space Flight Programs. More specifically, the objectives are threefold:

- a. To establish uniform standards for evaluating the degree and effectiveness of reliability practices and controls.
- b. To identify reliability type problems for evaluation and correction.
- c. To permit evaluation of the various methods of controlling a specific area leading to improved reliability and safety levels.

This standard is based on and is consistent with NASA Publication NPC 250-1; however, it may be used to survey contractual compliance to all reliability publications. It is designed to identify problem and improvement areas consistent with the severe reliability and safety requirements of Manned Space Flight Systems.

Comments and questions concerning the requirements set forth in this publication should be referred to the Office of Manned Space Flight (Code MIR-D), NASA Headquarters, Washington 25, D.C. Questions concerning its application to specific contracts should be referred to the cognizant NASA Center.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington, D.C.

August 1963



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## 1. EVALUATION PROCEDURES

### 1.1 INTRODUCTION

The reliability and quality requirements of the Manned Space Flight Program demand design, manufacture, test and operations reliability, and quality levels that far exceed those required in the past. The Reliability Program Evaluation Procedures presented in this section have been developed to assist in assessing the degree that reliability programs are properly related to the over-all needs of the Manned Space Flight Program, and to provide a base from which the specific action required to make the programs more effective can be developed.

### 1.2 RESPONSIBILITIES

#### 1.2.1 OMSF Responsibilities

The Office of Manned Space Flight will:

- a. Be responsible for the establishment and revision of evaluation procedures.
- b. Insure follow-up review of the reliability program requirements to determine the actions taken on deviations noted during the evaluation.
- c. Monitor scheduling and maintain a record of all evaluations and follow-up reviews.

#### 1.2.2 NASA Center Responsibilities

The cognizant NASA Centers will be responsible for implementing an effective program of periodic reliability program evaluations (surveys). More specifically, this will involve the following responsibilities:

- a. Schedule surveys.
- b. Designate a chairman of and direct the survey team.
- c. Notify the contractor, OMSF, and if applicable, the cognizant Government representative by letter at least 30 days prior to the date of the proposed survey.
- d. Conduct a presurvey conference at which team members will meet with contractor personnel at the contractor's facility. The survey team

chairman will explain the objectives and general plan of the evaluation for the understanding of all concerned.

- e. Conduct the surveys and evaluate the reliability program utilizing the procedures and checklists outlined herein.
- f. Conduct a postsurvey critique with contractor personnel and discuss the preliminary results of the evaluation. The contractor should be given an opportunity to explain any unusual or discrepant information obtained.
- g. The chairman of the survey team will be responsible for preparing a final report of the evaluation for the NASA Center and OMSF. Copies of this report will be sent to evaluation team members and other activities as necessary. The contractor will be notified, in writing, of the results of the evaluation and action necessary to correct or improve deficiencies.
- h. Follow up specific survey results to determine the action taken as a result of deficiencies noted during the survey. The assistance of the cognizant Government representative and resident Apollo System Project Office, if applicable, will normally be utilized to the maximum extent in this follow-up.
- i. Maintain records of all survey reports and related follow-up summaries.
- j. Transmit to OMSF copies of all survey reports and related follow-up summaries with copies to other NASA Centers and team members as appropriate.

#### 1.2.3 Survey Representatives

Survey teams will usually be comprised of the following members:

- a. NASA Center chairman and designated representatives.
- b. Cognizant Government representative (if applicable).
- c. OMSF representatives.

### 1.3 ACTIVITY AREAS

Reliability program activities consist essentially of a network of interrelated procedures and controls that are designed to assure an end product which meets Manned Space Flight Program needs. This reliability program extends throughout the entire organization in its Work Element coverage; and in its time-phased coverage extends from initial contract definition throughout the entire program.



A reliability program can be considered to consist of 12 major Activity Areas, each bearing a separate and distinct relationship to the over-all program. These Activity Areas are described in NPC 250-1 and are listed as follows:

1. Program Management.
2. Design Specifications.
3. Reliability Prediction and Estimation.
4. Failure Mode, Effect, and Criticality Analysis.
5. Human Engineering and Maintainability.
6. Design Review Program.
7. Failure Reporting and Correction.
8. Standardization of Design Practices.
9. Parts and Materials Program.
10. Equipment Logs.
11. Reliability Evaluation.
12. Documentation of Reliability Program.

An evaluation of the Degree of Effective Coverage for each Activity Area can be established by determining the importance of individual Work Elements and the determination of the Degree of Effective Coverage provided for each within individual Activity Areas. Similarly an over-all Reliability Program Evaluation of an entire reliability program can be developed from compiling the results of the individual Activity Area evaluation.

#### 1.4 EVALUATION PROCEDURE

##### 1.4.1 Objectives

Reliability evaluations are conducted to provide a means of:

- a. Determining effective reliability program coverage in terms of Manned Space Flight Program needs.
- b. Determining effective reliability program coverage in terms of specific contractual requirements.
- c. Determining the relative strengths and weaknesses in each of the major Activity Areas.
- d. Determining the relative strengths and weaknesses of the individual Work Elements that make up each Activity Area.

- e. Measuring, through subsequent surveys, changes in effectiveness of reliability activities.
- f. Making recommendations for improving, strengthening, or de-emphasizing Activity Areas.

#### 1.4.2 Evaluation Procedure Steps

In meeting the above objectives the Reliability Program Evaluation is performed in the following basic steps.

- a. Determining the Relative Importance (in percent) of each of the reliability Activity Areas to the specific program in terms of Manned Space Flight Program needs.
- b. Determining the Relative Importance (1 to 10) of the individual Work Elements within each of the Activity Areas.
- c. Establishing the Degree of Effective Coverage (0, 20, 40, 60, 80, or 100 percent) of the individual Work Elements within each of the Activity Areas.
- d. Listing related document number and date (where applicable) for individual Work Elements.
- e. Determining the current assignment of Functional Responsibility for each of the individual Work Elements.
- f. Developing a Weighted Effective Rating for each Work Element by multiplying the Relative Importance Factor by the Degree of Effective Coverage.
- g. For each Work Element subtracting the Weighted Effective Coverage Rating from the Relative Importance Factor to evaluate each Work Element in terms of need for action and priority. (The higher the number the greater the need.)
- h. Developing (similar to step f) a composite Weighted Effective Coverage Rating for each Activity Area based on Effective Coverage Ratings on individual Work Elements.
- i. For each Activity Area (similar to step g) subtracting the Weighted Effective Coverage Rating from the Relative Importance Factor to evaluate each Activity Area in terms of need for action and priority. (The higher the number the greater the need.)
- j. Developing and establishing specific recommendations to increase the effectiveness of the Manned Space Flight Reliability Program.

- k. Reviewing survey reports to identify Activity Areas and Work Elements where improved reliability procedures and controls are needed.
- l. Reviewing survey reports to determine Activity Areas and Work Elements where exceptionally effective reliability procedures and controls have been identified.

#### 1.4.3 Contractual Compliance Procedure Steps

In determining compliance to specific contractual requirements, only a slight modification to the above procedure is required and is accomplished as follows:

- a. The individual Work Elements within the Activity Areas are recollated, as applicable, against the requirements of the specific contractual documents, thereby replacing the Activity Areas by Contractual Requirement Areas.
- b. Establishment of Relative Importance Factors for the Work Elements within the Contractual Requirement Areas.
- c. Upon completion of step e, in the preceding 12-step procedure, the results of step c of that procedure (Degree of Effective Coverage), step d (applicable document number and date), and step e (assignment of Functional Responsibility) are posted to this revised breakdown.
- d. Steps f through l are then repeated on a Contractual Requirement Area basis instead of an Activity Area basis.

Contractual requirement evaluations will supplement, not replace, the procedure of paragraph 1.4.2 due to the greater coverage required by increased reliability and safety needs of Manned Space Flight Programs.

### 1.5 SCORING METHODS

#### 1.5.1 Determining the Relative Importance of Activity Areas

Each of the Activity Areas listed in paragraph 1.3 has a separate and distinct contribution in a reliability program. However, all of these Activity Areas are not independent and a major weakness within a reliability program in one of these Activity Areas can have a decided effect upon the contribution of the other Activity Areas.

In the implementation of the Reliability Program Survey, the first step is to establish Relative Importance Factors for each Activity Area. For initial planning purposes, a

set of Relative Importance Factors has been established as shown on page 2-5. These Relative Importance Factors can be revised in later surveys to reflect adjustments indicated for the type of program being surveyed.

#### 1.5.2 Determining the Relative Importance of the Individual Work Elements of Each Activity Area

Each of the Activity Areas is made up of a number of Work Elements. These elements describe the key reliability procedures and controls that are necessary to obtain maximum results from the Activity Area. The Work Elements are in the form of numbered declarative statements with an affirmative response scoring favorably. The number of Work Elements used for each activity varies with the complexity of the activity. The Work Elements are grouped under subheadings for easy reference. It is intended that the Work Elements, but not the subheadings, be scored. These Work Elements can be used in a survey regardless of the specifications and/or other requirements of the contract as indicated in paragraph 1.4.3. Work Elements within an Activity Area are not equally important. Initial Relative Importance Factors have been established for each Work Element as noted in Column A of the survey checklist (Section 2). These factors will be subject to revision based on survey experience.

#### 1.5.3 Rating Work Elements for Degree of Effective Coverage

The successful application of a Reliability Program Survey in fulfilling its objectives as a program status and improvement tool, lies in the logical and accurate evaluation of the Degree of Effective Coverage currently provided against each Work Element.

It should be recognized that the assignment of the Relative Importance Factor for Work Elements (paragraph 1.5.2) and the determination of their current Degree of Effective Coverage are directed at establishing those Work Elements and those activities that merit the highest priority of action to strengthen the program coverage and effectiveness. Some Work Elements of an Activity Area may be highly important but have a low Degree of Effective Coverage. It is those Work Elements that have the highest combination of Relative Importance and lack of Effective Coverage that will merit highest priority of action.

As shown in Column B of Figure 1-1, when rating the Degree of Effective Coverage, each Work Element will be given a rating of 0, 20, 40, 60, 80, or 100 percent. This rating expresses, in percentage points, the Degree of Effective Coverage of the Work

# RELIABILITY PROGRAM EVALUATION

CENTER <u>    </u> A <u>    </u> CONTRACTOR <u>    </u> B <u>    </u> NO. <u>    </u> 2 <u>    </u> DATE <u>    </u> 3-13-63 <u>    </u>		Function Resp. for Work El.	Rel. Need (A - C)	Weighted Eff. Coverage (A X B)	Degree of Eff. Coverage (%)	Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.	
ACTIVITY AREA: DESIGN SPECIFICATIONS												
WORK ELEMENTS												
2.7	Applicable Government specifications are reviewed for adequacy and necessary supplements are provided to define the reliability requirements of the article to be produced.						5	80	4.0		Rel.	
2.8	Reliability specifications are maintained current.						3	80	2.4		Rel.	
Doc. No. <u>    </u> 306 <u>    </u> Title <u>Reliability Requirements</u> Date <u>    </u> 3-13-62 <u>    </u>												

Figure 1-1. Examples of Degree of Effective Coverage and Weighted Effective Coverage

Element found by the survey team personnel. Satisfactory coverage warrants a rating of 100 percent. Ratings less than 100 percent should be supported by adequate notes.

The product of Column B and Column A is now inserted in Column C to give a quantity that represents the Weighted Effective Coverage of the Work Element.

#### 1.5.4 Determining Document Numbers and Dates

Where applicable to individual work statements, the related document numbers, titles, and dates which reflect compliance are recorded as indicated in Figure 1-1. This might be a special or periodic report or procedure, for example.

#### 1.5.5 Determining Current Assignment of Functional Responsibility for Work Elements

The Column E (Function Responsible for Work Element) will be filled-in to indicate the organization unit responsible for the Work Element.

The possibility of multiple assignments or the lack of assignments must also be recorded as appropriate. Important details that cannot be stated in this column should be supplied in a supporting narrative report, which will be referenced in Column E.

#### 1.5.6 Determining the Relative Need for Action of the Individual Work Elements of an Activity

When reviewing the results of surveys or when recommending corrective action, it is desirable to point out the extent of lack of coverage of Work Elements and to include at the same time the Relative Importance aspect of the Work Elements. To do this, subtract Weighted Degree of Effective Coverage (Column C) from Established Importance Factor (Column A). The result is then placed in Column D. The higher the number, the greater the need.

#### 1.5.7 Developing Activity Area Effective Coverage Ratings

The Degree of Effective Coverage of an Activity Area is a function of the Degree of Effective Coverage of its individual Work Elements weighted by their Importance Factor. The mechanics of determining the Activity Area Degree of Effective Coverage are shown in Figure 1-2 and are detailed as follows:

# RELIABILITY PROGRAM EVALUATION

CENTER     A     CONTRACTOR     B     NO.     2     DATE     3-13-63    

ACTIVITY AREA:     DESIGN SPECIFICATIONS    

## WORK ELEMENTS

		A.	B.	C.	D.	E.
	Estab. Rel. Imp. Fac. (1-10)	Degree of Eff. Coverage (%)	Weighted Eff. Coverage (A X B)	Rel. Need (A - C)	Function Resp. for Work El.	
2.7	Applicable Government specifications are reviewed for adequacy and necessary supplements are provided to define the reliability requirements of the article to be produced.	5	80	4.0	1.0	Rel.
2.8	Reliability specifications are maintained current.	3	80	2.4	0.6	Rel.
	Doc. No. <u>    306    </u> Title <u>Reliability Requirements</u> Date <u>    3-13-62    </u>					
	Suppose sum of Column A = 76 and the sum of Column C = 60					
	$(C \div A) \times 100$ , or					
	$60 \div 76 \times 100 = 79$ percent.					
	Note: This 79 percent is the degree of effective coverage for all of activity area 2.0 and would be recorded in Column B on page 2-5.					
	Totals	76	xxx	60	xxx	xxx

Figure 1-2. Example of Activity Area Degree of Effective Coverage Calculation

- a. Add the Weighted Degree of Effective Coverage for all Work Elements (Column C) to obtain a total for the activity.
- b. Add the Relative Importance Factors for all Work Elements (Column A) to obtain a total for the activity.
- c. Divide the activity total for Weighted Degree of Effective Coverage (step a) by the activity total for the Relative Importance Factor (step b). The result is the Activity Degree of Effective Coverage and should be noted on the last page of the Activity Work Element sheets. As shown in Figure 1-3, the Activity Degree of Effective Coverage number should also be inserted in Column B of the reliability program evaluation summary sheet.

#### 1.5.8 Rating Activity Areas in Terms of Need for Action

The procedure for rating Activity Areas in terms of need for action is identical to the procedure for rating the Work Elements. The Relative Need (Column D) is the difference between the Established Importance Factor (Column A) and the Weighted Degree of Effective Coverage (Column C).

#### 1.5.9 Determining Over-all Degree of Effective Coverage

The over-all Degree of Effective Coverage for each reliability program is established directly from the Relative Importance Factors of the individual Activity Areas and their associated degree of current Effective Coverage. It is developed in the same manner as the Degree of Effective Coverage of the Activity Areas was established except all Importance Factors must add to 100 percent as shown in Figure 1-3.

The Relative Importance Factor (Column A) established for each Activity Area is multiplied by the Degree of Effective Coverage determined for that activity (Column B), and the result, representing a Weighted Effective Coverage figure in percent, is inserted in Column C.

The sum of Weighted Effective Coverages (Column C) is then totaled and is a percent representing the degree of over-all reliability program coverage.



RELIABILITY PROGRAM EVALUATION  
SUMMARY SHEET

CENTER \_\_\_\_\_ CONTRACTOR \_\_\_\_\_ DATE \_\_\_\_\_

	Estab. Rel. Imp. Fac. (1-10)	A.	Degree of Eff. Coverage (%)	B.	Weighted Eff. Coverage (A X B)	C.	Rel. Need (A - C)	D.
1.0 Program management		10		80		8.0		2.0
2.0 Design specifications		8		80		6.4		1.6
3.0 Reliability prediction and estimation		6		40		3.2		4.8
4.0 Failure mode, effect, and criticality analysis		11		60		6.6		4.4
5.0 Human engineering and maintainability		10		80		8.0		2.0
6.0 Design review program		8		80		6.4		1.6
7.0 Failure reporting and correction		8		40		3.2		4.8
8.0 Standardization of design practices		13		80		10.4		2.6
9.0 Parts and materials program		7		60		4.2		2.8
10.0 Equipment logs		3		20		0.6		2.4
11.0 Reliability evaluation		10		80		8.0		2.0
12.0 Documentation of reliability program		4		60		2.4		1.6
Totals		100		XXX		67.4		XXX

Figure 1-3. Example of Reliability Program Evaluation Summary Sheet Calculations

## 2. RELIABILITY PROGRAM EVALUATION CHECKLISTS

### 2.1 INTRODUCTION

This section contains the Reliability Program Evaluation Summary Sheet for rating and evaluating the twelve Activity Areas. It also contains the individual Activity Area checklists for use in rating and evaluating the Work Elements that comprise each Activity Area.

QUALITY PROGRAM EVALUATION

Survey No. \_\_\_\_\_

Center \_\_\_\_\_

Contractor \_\_\_\_\_

Code \_\_\_\_\_

Code \_\_\_\_\_

Contract No. \_\_\_\_\_

Contract Name \_\_\_\_\_

Survey Dates \_\_\_\_\_

Report Date \_\_\_\_\_

Team Chairman \_\_\_\_\_

Team Members \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

National Aeronautics and Space Administration

## RELIABILITY PROGRAM EVALUATION SUMMARY SHEET

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREAS		A.	B.	C.	D.	E.
1.0	Program Management	10				
2.0	Design Specifications	8				
3.0	Reliability Prediction and Estimation	8				
4.0	Failure Mode, Effect, and Criticality Analysis	11				
5.0	Human Engineering and Maintainability	10				
6.0	Design Review Program	8				
7.0	Failure Reporting and Correction	8				
8.0	Standardization of Design Practices	13				
9.0	Parts and Materials Program	7				
10.0	Equipment Logs	3				
11.0	Reliability Evaluation	10				
12.0	Documentation of Reliability Program	4				
Totals		100				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Etab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 1.0 PROGRAM MANAGEMENT		A.	B.	C.	D.	E.
WORK ELEMENTS						
1.1	<u>Introduction</u> NPC 250-1 is contractual (list other specifications or scopes of work)   	10				
1.2	No exceptions to NPC 250-1 have been taken (list exceptions)   	10				
1.3	The program is adequately staffed with reliability engineers.	10				
1.4	The reliability program is an identifiable item of work in the contract.	10				
1.5	Subcontractor reliability programs are identifiable items of work in the contract.	10				
1.6	The reliability program item of work is funded at \$ _____	3				
1.7	Numerical reliability requirements are specified in the contract or product specification.	10				
1.8	Reliability acceptance tests are specified in the contract or product specification.	10				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El.	Rel. Need (A - C)	Weighted Eff. Coverage (A X B)	Degree of Eff. Coverage (%)	Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.
ACTIVITY AREA: 1.0 PROGRAM MANAGEMENT											
WORK ELEMENTS											
1.9	<p><u>Organization</u></p> <p>There exists one well-identified group within the organization which is responsible for management of the reliability program.</p> <p>Doc. No. _____ Title _____ Date _____</p>				5						
1.10	<p>This organization has previously performed under contracts wherein a quantitative reliability acceptance test has been a specified requirement. (If yes, list contract number, related reports, the item(s) furnished, the reliability attained, the contracting agency, and the name of the principal reliability contact of that agency.)</p> <p>_____</p> <p>_____</p> <p>_____</p>				5						
1.11	<p>The authority delegated to the reliability group and other reliability organizations to control and monitor the reliability program is clearly stipulated and documented.</p> <p>Doc. No. _____ Title _____ Date _____</p>				5						
1.12	<p>Reliability engineering job descriptions require appropriate education and experience.</p> <p>Doc. No. _____ Title _____ Date _____</p>				10						

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El.				
ACTIVITY AREA: 1.0 PROGRAM MANAGEMENT		Rel. Need (A - C)				
WORK ELEMENTS		Weighted Eff. Coverage (A X B)				
		Degree of Eff. Coverage (%)				
		Etab. Rel. Imp. Fac. (1-10)				
		A.	B.	C.	D.	E.
1.13	There are established within separate divisions, departments, or test facilities, local reliability policies or procedures which are in conformance with, and implement the over-all reliability program.	3				
	Doc. No. _____ Title _____ Date _____					
1.14	The reliability organization has responsibility for design and specifications review and timely sign off approval of all specifications and all design review reports including follow-up of corrective actions.	10				
1.15	Proposed design changes are reviewed and approved by the reliability function.	7				
1.16	The reliability organization has responsibility for reliability apportionment.	7				
1.17	The reliability organization has primary responsibility for reliability indoctrination and training.	3				
1.18	The reliability organization has responsibility for assuring analysis of all failures.	10				
1.19	The reliability organization has responsibility for initiation of corrective action for failures.	5				
1.20	Management has and supports a reliability research program to develop and apply advanced reliability techniques.	3				
	Doc. No. _____ Title _____ Date _____					
1.21	Management and the reliability group are familiar with the requirements of: a. NPC 250-1 Reliability Program Provisions for Space System Contractors. b. MIL-R-27542 Reliability Program Requirements for Aerospace Systems, Sub-systems, and Equipment. c. MIL-R-26667 Reliability and Longevity Requirements, Electronic Equipment, General Specification for.	5				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El.	Rel. Need (A - C)	Weighted Eff. Coverage (A X B)	Degree of Eff. Coverage (%)	Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.
ACTIVITY AREA: 1.0 PROGRAM MANAGEMENT											
WORK ELEMENTS											
d. MIL-M-26512 Maintainability Requirements for Weapon Systems and Subsystems. e. MIL-STD-441 Reliability of Military Electronic Equipment. f. MIL-STD-756 Reliability of Weapons Systems, Procedures for Prediction, and Reporting Prediction of. g. NPC 200-2 Quality Program Provisions for Space System Contractors.											
<u>Reliability Program Control</u>											
1.22	The reliability program has been scheduled by tasks to permit estimates of people, skills, materials, facilities, services, and time requirements.				5						
1.23	Doc. No. _____ Title _____ Date _____ The reliability program costs have been estimated and budgets have been established for each specific reliability task scheduled.				5						
1.24	Doc. No. _____ Title _____ Date _____ Environmental test equipment and facilities are available in-house to conduct development and qualification testing or adequate commercial facilities are available within a convenient operating distance.				10						
1.25	Reliability program tasks and milestones are scheduled so that they are integrated with the over-all program schedules.				7						
1.26	Reliability personnel establish time intervals for reliability activities when programs are scheduled or PERTed.				5						
1.27	The reliability group participates in the preparation of the contract proposal and provides definition of the reliability tasks to be performed.				5						



# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		<div>Function Resp. for Work El.</div> <div>Rel. Need (A - C)</div> <div>Weighted Eff. Coverage (A X B)</div> <div>Degree of Eff. Coverage (%)</div> <div>Etab. Rel. Imp. Fac. (1-10)</div>				
ACTIVITY AREA: 1.0 PROGRAM MANAGEMENT		A.	B.	C.	D.	E.
WORK ELEMENTS						
1.28	The reliability program control provides for a sequence of reliability monitoring points and milestones through the development, design, and production of the product.	5				
1.29	The reliability group supports the identification of mission requirements, assures that they are compatible with performance specifications, and provides consistent reliability allocations.	5				
1.30	<u>Reliability Program Plan</u> A Reliability Program Plan document has been developed.	10				
1.31	Doc. No. _____ Title _____ Date _____ The Reliability Program Plan includes the following management data: a. Reliability Management Organization, responsibilities, and functional relationships to other elements of the over-all organization. b. Authorities delegated to the reliability management groups and other reliability organizations to control and monitor the reliability program.	5				
1.32	The Reliability Program Plan includes as a separate section a description of the reliability prediction and tradeoff procedures to be applied.	5				
1.33	The Reliability Program Plan includes a description of the contractor's failure mode and affects procedures to be applied.	5				
1.34	The Reliability Program Plan includes a description of the contractor's parts and materials program (including selection, reduction in number of types, evaluation, specification, qualification, and application review procedures of parts and materials for all items to be used in the system).	5				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		WORK ELEMENTS				
ACTIVITY AREA: 1.0 PROGRAM MANAGEMENT		Etab. Rel. Imp. Fac. (1-10)	Degree of Eff. Coverage (%)	Weighted Eff. Coverage (A X B)	Rel. Need (A - C)	Function Resp. for Work El.
		A.	B.	C.	D.	E.
1.35	The Reliability Program Plan includes a detailed description of the failure reporting and correction system (including procedures, organizational responsibilities, format, and numbering of reports).	5				
1.36	The Reliability Program Plan includes, or references, a detailed description of the Design Review Program, including practices and procedures employed, a checklist of design aspects to be covered, a schedule of individual reviews, and signoff approval requirements for reliability engineers.	10				
1.37	The Reliability Program Plan includes a detailed outline of the contractor's reliability training program.	3				
1.38	The Reliability Program Plan includes a plan for the acquisition and utilization of reliability data for Government furnished materials.	3				
1.39	The Reliability Program Plan includes a written plan for reliability control of subcontractors and vendors.	5				
1.40	The Reliability Program Plan includes change control procedures, in written form, for the distribution and implementation of engineering change orders, control changes, and drawing changes.	5				
1.41	The Reliability Program Plan includes the format to be used for equipment logs and operating time recording procedures.	1				
1.42	The Reliability Program Plan includes the contractor's reliability demonstration plan relative to the reliability requirements specified in the contract.	5				
	<u>Reliability Program Reviews</u>					
1.43	Formal reviews of the reliability program are scheduled at designated intervals (program milestones, specified periods, or other).	7				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 1.0 PROGRAM MANAGEMENT		A.	B.	C.	D.	E.
WORK ELEMENTS						
1.44	Results of formal reviews are documented.	3				
	Doc. No. _____ Title _____ Date _____					
1.45	Revisions to the reliability program plan resulting from formal reviews are implemented in a timely manner.	5				
	<u>Reliability Indoctrination and Training</u>					
1.46	A training program has been developed, documented for reliability and other personnel who may have an effect upon, or who are responsible for, the determination of product reliability.	7				
	Doc. No. _____ Title _____ Date _____					
1.47	The Director (or Manager) of reliability conducts, on a continuing basis, numerous informal reliability conferences with key engineering, procurement, test, quality, and project-management personnel on each project.	3				
1.48	Formal training is balanced with dissemination of useful reliability information, effective, well-planned posters and lectures on training to preclude failures.	1				
1.49	The reliability group publishes (for use by design groups) technical articles on design techniques for obtaining higher reliability.	5				
	Doc. No. _____ Title _____ Date _____					
1.50	Formalized reliability indoctrination courses are conducted for new design and engineering employees.	10				
1.51	Design and reliability manuals and publications are of adequate technical level, quality, and quantity.	7				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Etab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 1.0 PROGRAM MANAGEMENT		A.	B.	C.	D.	E.
WORK ELEMENTS						
1.52	Design reliability engineering prepares a formal series of briefings on reliability techniques and practices for field operation personnel.	5				
1.53	Reliability indoctrination of key personnel is required to be conducted in supplier's organizations.	5				
	Doc. No. _____ Title _____ Date _____					
	<u>Subcontractor and Supplier Control</u>					
1.54	Cost-reliability tradeoff study results are included in negotiations with suppliers.	3				
1.55	Reliability personnel evaluate supplier's reliability organization, program plans, procedures, personnel qualification and proposals prior to selection of suppliers.	10				
	Doc. No. _____ Title _____ Date _____					
1.56	Suppliers are provided with the details of usage environment, maintenance requirements, and other factors affecting mission reliability.	3				
1.57	Reliability personnel evaluate supplier's reliability predictions, failure analysis reports, corrective action statements, and product characteristics and parameters.	5				
1.58	Designated reliability personnel perform the following functions: a. Evaluate supplier's compliance with time-phased reliability program. b. Participate in supplier's design reviews. c. Maintain surveillance of supplier's reliability demonstration and acceptance tests. d. Evaluate supplier's compliance with reliability goals.	10				
1.59	Provisions for reliability control of subcontractors and suppliers of major components are maintained current and complete throughout the life of the program.					

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Degree of Eff. Coverage (%) Weighted Eff. Coverage (A X B) Rel. Need (A - C) Function Resp. for Work El.				
ACTIVITY AREA: 1.0 PROGRAM MANAGEMENT		A.	B.	C.	D.	E.
WORK ELEMENTS		A.	B.	C.	D.	E.
1.60	Reliability demonstrations are required of subcontractors to insure that the reliability of production articles will be maintained.	10				
	Doc. No. _____ Title _____ Date _____					
1.61	Reliability feedback is provided to suppliers in the form of reliability rating of the product, nature of discrepancies, and nature of required improvements.	7				
	Doc. No. _____ Title _____ Date _____					
1.62	Formal procurement specifications are prepared, citing specific reliability requirements for parts and materials not classed as major system elements.	5				
1.63	Current files are maintained of all subcontractor reliability organization charts and operating procedures.	1				
	Doc. No. _____ Title _____ Date _____					
1.64	Reliability demonstrations and evaluation tests are performed on new or unqualified supplier's products prior to approval of the part as an acceptable standard part.	5				
1.65	Procurement source approval is based upon reliability history records or a survey report.	10				
	Doc. No. _____ Title _____ Date _____					
1.66	Subcontractor configuration control is approved and controlled by the customer.	5				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 2.0 DESIGN SPECIFICATIONS		A.	B.	C.	D.	E.
WORK ELEMENTS						
2.1	Design specifications are prepared for each system, subsystem, and component to the level of assembly and extent prescribed by the contracting agency.	7				
2.2	Design specifications or supplements to existing specifications specify detailed quantitative reliability requirements and related demonstration tests.	5				
2.3	Design specifications include functional descriptions and qualification test requirements.	5				
2.4	Design specifications include protective packaging requirements.	5				
2.5	Design specifications include inspection and test criteria, acceptance limits, and physical equipment identification marking requirements.	5				
2.6	Design specifications define the operating, storage, and transportation environments for each article.	5				
2.7	Applicable Government specifications are reviewed for adequacy, and necessary supplements are provided to define the reliability requirements of the articles to be produced.	5				
2.8	Reliability specifications are maintained current.	3				
Doc. No. _____ Title _____ Date _____						
2.9	Procedures require audit to assure that reliability requirements are accurately translated into design specifications.	5				
2.10	Design specifications are complete prior to final release for design implementation.	7				
2.11	Design specifications are released in time to permit implementation in accordance with approved program schedules.	7				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 3.0 RELIABILITY PREDICTION AND ESTIMATION		A.	B.	C.	D.	E.
WORK ELEMENTS						
3.1	The construction of the reliability prediction model is a well defined project, staffed and funded adequately.	10				
3.2	The mission profile, performance criteria, environmental profile requirements and contractual reliability requirements are included in system specifications.	10				
3.3	Performance criteria, environmental requirements, and reliability requirements based on apportionment of the system reliability requirements are included in subsystem and component specifications.	10				
3.4	Construction is started on the reliability prediction model during the conceptual engineering phase.	5				
3.5	The reliability prediction model contains definitions of crew safety and safety requirements for mission and for each flight phase.	3				
3.6	The reliability prediction model allocates the reliability requirement of the system to each subsystem and component as appropriate.	7				
3.7	System functional block diagrams showing apportionment of the over-all reliability requirements to the various subsystem elements are prepared.	7				
Doc. No. _____ Title _____ Date _____						
3.8	The reliability prediction model is revised at planned intervals, taking into account: <ul style="list-style-type: none"> <li>a. New information acquired from similar projects.</li> <li>b. Improvements resulting from invention and innovation.</li> <li>c. Specific reliability engineering analyses.</li> </ul>	5				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El.	Rel. Need (A - C)	Weighted Eff. Coverage (A X B)	Degree of Eff. Coverage (%)	Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.
ACTIVITY AREA: 3.0 RELIABILITY PREDICTION AND ESTIMATION											
WORK ELEMENTS											
3.9	d. Early laboratory testing. e. Production and field test results. f. Subcontractors' and suppliers' data. g. Changes from design review.						3				
3.10	A reliability prediction model is prepared prior to initial design review.						5				
3.11	Statistical techniques are used when data population is significant.						10				
3.12	The reliability of the components and system is predicted with consideration for: a. The specific application of each part. b. The derating curves for environmental stresses. c. The environmental stresses within and outside of the component.						3				
3.13	Logical mathematical approaches provide the basis for calculating the reliability of systems or subsystems with complex series and/or parallel modes of failure.  In the application of failure rates of parts to reliability equations, the following effects of failure rates are considered: a. Internal effects on the part and component. b. The direct effect of the component on the system or subsystem.						5				
3.14	Reliability predictions and assessments are based upon failure data obtained from applicable environmental and load conditions.						5				
3.15	The failure rates used in reliability predictions are those based on OMSF RA-11 with updating based on experienced failure data.						10				



# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Etab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 3.0 RELIABILITY PREDICTION AND ESTIMATION		A.	B.	C.	D.	E.
WORK ELEMENTS						
3.16	The reliability of complex equipment is analyzed by extrapolating data from existing equipment of similar complexity and reliability in similar environments.	10				
3.17	Probability distributions assumed are defined and documented.	5				
	<u>Utilization of Prediction</u>					
3.18	Mean time between failures (MTBF) and mean time to failure (MTTF) information is furnished to aid in establishing checkout procedures.	7				
3.19	Reliability predictions are used to support tradeoffs in weight, volume, performance and cost.	7				
	Doc. No. _____ Title _____ Date _____					
3.20	Reliability predictions are utilized in provisioning, scheduling, allocating spare assemblies, and assisting in determining logistics problem areas.	7				
	Doc. No. _____ Title _____ Date _____					
	<u>Failure Definition</u>					
3.21	Failure criticality is defined in terms of effect on reliability and safety of higher level systems.	5				
3.22	Definitions of failure are standardized by the reliability organization to assure consistent predictions that can be correlated with test and operational results.	10				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El.	Rel. Need (A - C)	Weighted Eff. Coverage (A X B)	Degree of Eff. Coverage (%)	Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.
ACTIVITY AREA: 3.0 RELIABILITY PREDICTION AND ESTIMATION											
WORK ELEMENTS											
<u>Estimation</u> The system used by the contractor to collect operation, test, and failure data can be and is tested for accuracy and completeness of data.		7									

3.23

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 4.0 FAILURE MODE, EFFECT AND CRITICALITY ANALYSIS		A.	B.	C.	D.	E.
WORK ELEMENTS						
4.1	A documented methodology exists for evaluating failure consequences through detailed failure cause, mode and effect analyses.	10				
4.2	Doc. No. _____ Title _____ Date _____ Failure mode and effect analyses are applied at the system, and subsystem, and equipment levels to establish the relative criticalness of failures.	10				
4.3	Doc. No. _____ Title _____ Date _____ The completed model is well detailed and suitable for purpose of reliability prediction by insertion of failure modes and mode failure rates.	5				
4.4	Pertinent environmental and load stresses applied to subsystems, components and parts are considered in arriving at projected failure modes.	5				
4.5	The reliability group evaluates all design discrepancies found through failure modes and effects analyses for effect on reliability and safety levels.	7				
4.6	Special analysis is conducted on each critical and major failure by the reliability function.	7				
4.7	Worst case analyses are required for all electronic circuits.	10				
	Doc. No. _____ Title _____ Date _____					

## RELIABILITY PROGRAM EVALUATION

CENTER \_\_\_\_\_ CONTRACTOR \_\_\_\_\_ NO. \_\_\_\_\_ DATE \_\_\_\_\_

ACTIVITY AREA: 5.0 HUMAN ENGINEERING AND MAINTAINABILITY

		WORK ELEMENTS					Function Resp. for Work El.				
							Rel. Need (A - C)				
							Weighted Eff. Coverage (A X B)				
							Degree of Eff. Coverage (%)				
							Etab. Rel. Imp. Fac. (1-10)				
							A.	B.	C.	D.	E.
5.1	A human engineering evaluation program beginning in the basic design phase is employed in determining system and component designs.	Doc. No. _____	Title _____	Date _____			10				
5.2	Specialized attention is given to operator capability to perform: a. Within limits of expected shock, noise, vibration, temperature, illumination, and radiation environments. b. For planned time periods without excessive fatigue. c. Written within psychological and physiological stress conditions.						7				
5.3	Design consideration is given to maximizing operator efficiency.						7				
5.4	A human error and safety audit is performed, considering manufacture, test, handling, operation and maintenance.						5				
5.5	Tradeoff studies are performed to minimize equipment complexity and maximize equipment reliability.						5				
5.6	Special handling and shipping instructions are provided to protect critical parts.						5				
5.7	A maintainability evaluation program beginning in the basic design phase is employed in determining system and component designs.						10				
5.8	Maximum use is made of standard parts, modules, components, circuits, and accessories to achieve a high degree of interchangeability.	Doc. No. _____	Title _____	Date _____			5				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		WORK ELEMENTS				
ACTIVITY AREA: 5.0 HUMAN ENGINEERING AND MAINTAINABILITY						
		Estab. Rel. Imp. Fac. (1-10)	Degree of Eff. Coverage (%)	Weighted Eff. Coverage (A X B)	Rel. Need (A - C)	Function Resp. for Work El.
		A.	B.	C.	D.	E.
5.9	Designers plan for rapid and easy replacement of malfunctioning units in equipment.	5				
5.10	Maximum use is made of readout and built in test equipment.	5				
5.11	All test and inspection equipment is designed with the maintenance problem in mind.	5				
5.12	Maintainability data used in the reliability prediction model is verified as soon as practicable.	7				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 6.0 DESIGN REVIEW PROGRAM		A.	B.	C.	D.	E.
WORK ELEMENTS						
<u>Design Review Schedules</u>						
6.1	A design review is held at the time a new design is in the planning stage and before the detailed design efforts or extensive breadboarding begin to consider the design philosophy and approaches required to meet the applicable specifications and to assure that the specifications themselves contain realistic requirements.	5				
6.2	A design review is held at the completion of breadboard testing and mechanical mockup. This includes a review of all standard components and parts, the specifications and test data for all special parts, circuit details including firm specifications for inputs and outputs, and mechanical details including firm specifications for vibration inputs and resonance levels.	5				
6.3	A design review is held after completion of prototype testing. This includes a review of all circuit and mechanical design changes; new part and component requirements introduced subsequent to the major review; and revisions to test procedures or performance specifications.	5				
<u>Design Review Coverage</u>						
6.4	Design reviews cover the following levels: a. Component. b. Subsystem. c. System.	7				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El.	Rel. Need (A - C)	Weighted Eff. Coverage (A X B)	Degree of Eff. Coverage (%)	Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.
ACTIVITY AREA: 6.0 DESIGN REVIEW PROGRAM											
WORK ELEMENTS											
6.5	Design reviews cover but are not limited to: a. Specifications. b. Drawings. c. Test data. d. Test procedures. e. Engineering instructions. f. Engineering change orders. g. Human factors studies. h. Test equipment. i. Parts application. j. Design practices and procedures. k. Safety margins. l. Derating. m. Maintainability provisions. n. Repairability. o. Producibility.				5						
6.6	Design reviews are conducted on major design changes to determine effect on reliability, maintainability, producibility, mission success, and safety.				5						
6.7	<u>Design Review Procedures</u> A formal design review program exists and is documented.				10						
6.8	Doc. No. _____ Title _____ Date _____ Organizational participation in design review is formally documented in the Design Review Program.				1						
6.9	The design review procedure documentation is maintained current.				3						
6.10	The reliability function is responsible for follow-up of corrective actions resulting from design reviews.				10						
6.11	<u>Reports and Records</u> Complete and definitive design review reports are prepared and submitted to proper management levels in a timely manner.				5						
6.12	Records are maintained of all design reviews and resulting design changes.				3						

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El.	Rel. Need (A - C)	Weighted Eff. Coverage (A X B)	Degree of Eff. Coverage (%)	Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.
ACTIVITY AREA: 6.0 DESIGN REVIEW PROGRAM											
WORK ELEMENTS											
6.13	All engineering instructions and engineering change-documents or other changes resulting from design reviews are audited at regular intervals for adherence to design review decisions.				3						
6.14	Action taken on design review reports and results thereof are suitably documented and reported to responsible parties.				7						
6.15	Representatives from design, manufacturing, reliability, quality control, and parts application participate in design reviews.				5						
6.16	Both System and Component oriented reliability engineers participate in the design review.				5						
6.17	Reliability personnel sign off and approve all design reviews.				10						
<u>Design Review Support</u>											
6.18	Up-to-date versions of the following are available at design reviews: a. Stated reliability requirements. b. Reliability specifications. c. Failure rate versus stress information on parts. d. Reliability block diagrams. e. Reliability allocations. f. Component and part failure rate predictions. g. Parts lists. h. Specific environmental stress limits for parts and components.				5						
6.19	Design review procedures include checklists or design guides.				3						



# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		WORK ELEMENTS				
ACTIVITY AREA: 6.0 DESIGN REVIEW PROGRAM		A.	B.	C.	D.	E.
		Estab. Rel. Imp. Fac. (1-10)	Degree of Eff. Coverage (%)	Weighted Eff. Coverage (A X B)	Rel. Need (A - C)	Function Resp. for Work El.
6.20	External Advance notification of a design review is furnished 15 days prior to each review.	5				
6.21	Notification of design review includes system element to be reviewed, date, time, and location.	1				
6.22	Notification of design review is accompanied by specified data for advance preparation by attendees.	3				
6.23	Timely requirements are placed on subcontractors to implement design review programs for their activities.	1				

# RELIABILITY PROGRAM EVALUATION

		NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Etab. Rel. Imp. Fac. (1-10)				
				A.	B.	C.	D.	E.
CENTER _____ CONTRACTOR _____ ACTIVITY AREA: 7.0 FAILURE REPORTING AND CORRECTION								
WORK ELEMENTS								
7.1	The reliability organization has responsibility for failure reporting surveillance.			3				
7.2	A detailed description of the failure reporting and correction system exists, including organization, responsibilities, format, and report numbering system.			5				
7.3	Doc. No. _____ Title _____ Date _____ A reliability data center is provided and is equipped to receive, compile, store, and reproduce reliability information.			5				
7.4	Failure data collected include but are not limited to: a. Failure reports. b. Failure analysis reports. c. Failure corrective action reports. d. Time log of failed parts. e. Failure mode analysis report. f. Failure effect analysis report. g. Failure rate reports. h. Specifications. i. Drawings. j. Parts Lists. k. Qualification test data. l. Test maintenance log. m. Engineering change order.			10				
7.5	Failure data reported are complete and include description of discrepancy, stress, cause, and total operating time to failure.			7				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El.	Rel. Need (A - C)	Weighted Eff. Coverage (A X B)	Degree of Eff. Coverage (%)	Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.
ACTIVITY AREA: 7.0 FAILURE REPORTING AND CORRECTION											
WORK ELEMENTS											
7.6	Failure data are collected, analyzed, and disseminated in a timely manner to contractor's organization, to suppliers, and to NASA or its designated representative.				5		5				
7.7	Information feedback and corrective action follow-up is provided to the design organization on all deficiencies discovered during the inspections and tests of articles.				5		5				
7.8	A documented, multiple, closed-loop plan provides for formal notification of need for corrective action to design or manufacturing areas, and to suppliers.				5		5				
7.9	Doc. No. _____ Title _____ Date _____ A documented, multiple closed-loop plan provides for periodic reporting of accountability for action for each deficiency or failure until adequate corrective action is verified by the reliability organization.				7		7				
7.10	Doc. No. _____ Title _____ Date _____ Laboratory analysis of significant part failures is required by procedure and is monitored by the reliability organization.				7		7				
7.11	Every failure is reviewed by the reliability function for evidence of a cause of recurring discrepancies.				3		3				
7.12	Procedures exist specifying distribution of all discrepancy and malfunction data received from customer evaluation programs.				3		3				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 8.0 STANDARDIZATION OF DESIGN PRACTICE		A.	B.	C.	D.	E.
WORK ELEMENTS						
	<u>Standardization</u>					
8.1	A standard practices manual is formalized and maintained current.	7				
8.2	Design manuals are established to provide design standards for the product design of high-reliability electronic, electrical, mechanical, pneumatic and hydraulic components. (Ex: Naval Electronics Laboratory Reliability Handbook.)	5				
8.3	Up-to-date files of drawings, parts specifications, and catalog data are maintained.	5				
8.4	Published procedures state the signature approvals required for proper control of deviations from the requirements of the standard practices manual.	5				
8.5	Design engineers use the following during design creation: <ul style="list-style-type: none"> <li>a. Reliability Handbook.</li> <li>b. Approved Parts Lists.</li> <li>c. Parts Application Guide.</li> <li>d. Failure Rate Predictions.</li> <li>e. Reliability Block Diagrams.</li> </ul>	5				
8.6	An engineering standards group prepares and maintains current standards data for use by design engineering.	7				
8.7	A morgue of unreliable or failed parts is maintained.	1				
8.8	Standards manuals specify methods of marking, coding, serialization, and labeling.	3				
8.9	Circuits from preferred or "qualified" circuit files, having known high reliability histories of success are used.	10				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Etab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 8.0 STANDARDIZATION OF DESIGN PRACTICE		A.	B.	C.	D.	E.
WORK ELEMENTS						
8.10	New designs are extensively evaluated and included in the standard practice manual, if applicable.	5				
8.11	A standards program is maintained insuring positive control of measurement reference throughout the plant with mandatory periodic calibration intervals.	5				
8.12	<u>Procedures and Practices</u> Applicable NASA reliability program requirements are specified in purchase orders to all major subcontractors and on suppliers of all major components.	7				
8.13	Adequate thermal design techniques are used.	10				
8.14	The best available methods are used for reducing the adverse effects of operational environments on critical parts.	10				
8.15	Environmental stress considerations and analyses for subsystems are studied during the development and design phases of engineering.	5				
8.16	Procedures require appropriate review and approval for use of parts not fully qualified for an application or which must be specially selected from stock.	10				
Doc. No. _____ Title _____ Date _____						
8.17	Adequate mechanical design techniques are used.	10				
8.18	Consideration has been given to ease and economy of manufacture, including inspection and testing.	5				
8.19	Adequate electrical design techniques are used.	10				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		WORK ELEMENTS				
ACTIVITY AREA: 8.0 STANDARDIZATION OF DESIGN PRACTICE		Estab. Rel. Imp. Fac. (1-10)	Degree of Eff. Coverage (%)	Weighted Eff. Coverage (A X B)	Rel. Need (A - C)	Function Resp. for Work El.
		A.	B.	C.	D.	E.
8.20	In large systems electrical, hydraulic and pneumatic mockups are provided.	5				
8.21	Special handling and shipping instructions are specified to protect critical parts.	3				
8.22	Design engineering reviews special procedures developed to protect parts and components from overstress, damage and mishandling in the Manufacturing, Test and Operations.	5				
8.23	Proven design techniques and inspection criteria for metal joining processes such as soldering, brazing and welding are employed.	3				
8.24	Malfunction-indicating circuits or devices are incorporated where practicable and necessary in major elements of the system, with due regard for over-all reliability.	3				
8.25	Self-monitoring or self-calibration devices are incorporated where practicable and necessary in major systems.	3				
8.26	Consideration is given to marginal testing for critical parts.	5				
8.27	Limited life parts are given special recognition. Inspection and replacement requirements are specified.	5				
	Doc. No. _____ Title _____ Date _____					
8.28	The principal dynamic stresses on the package or functional assembly are calculated. An accurate model is tested with proper and sufficient instrumentation.	5				
8.29	The structural packaging of the equipment is reviewed to assure that an excessively severe environment is not developed by the proximity of other parts or components.	7				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 8.0 STANDARDIZATION OF DESIGN PRACTICE		A.	B.	C.	D.	E.
WORK ELEMENTS						
8.30	Positive configuration control procedures are provided.	7				
8.31	Engineering change orders are formally documented and permanently filed.	1				
8.32	The change control system provides for removal of drawings, drawing changes, and engineering change orders from the manufacturing and inspection areas as they become obsolete.	3				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		WORK ELEMENTS					
ACTIVITY AREA: 9.0 PARTS AND MATERIALS PROGRAM		Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.
			Degree of Eff. Coverage (%)	Weighted Eff. Coverage (A X B)	Rel. Need (A - C)	Function Resp. for Work El.	
9.1	Reliability approved source lists are maintained for each part.		5				
9.2	The reliability function supplies applications data, including derating factors performance characteristics, and failure rates to the designer.		10				
9.3	Parts which have not been previously qualified are subjected to a statistically designed test to determine failure rates and failure modes under all anticipated environments.		5				
9.4	Parts which have been modified subsequent to qualification are subjected to adequate requalification tests before use.		7				
9.5	Spares provisioning considers the part replacement rate, lead times, part costs, recorder costs, storage costs, storage failure rates (shelf life) and the cost of program delay.		7				
9.6	Part and material specifications include maximum environmental limits.		5				
9.7	Parts and materials specialists approve and sign off all parts and materials applications.		10				
9.8	Standardized data exchange programs (i. e., IDEP, Battelle, etc.) are utilized in parts selection where practical.		5				
9.9	The applications of parts are checked and reviewed prior to formal design review to assure that no part is inadvertently overstressed or damaged by its application.		5				



# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		WORK ELEMENTS					
ACTIVITY AREA: 10.0 EQUIPMENT LOGS		Estab. Rel. Imp. Fac. (1-10)	A.	B.	C.	D.	E.
		Degree of Eff. Coverage (%)	Weighted Eff. Coverage (A X B)	Rel. Need (A - C)	Function Resp. for Work El.		
10.1	Separate and complete equipment logs are maintained for each major component, subsystem and system for the total time from initial testing to post-flight debriefing.	10					
10.2	Equipment logs satisfy the data requirements of paragraph 3.10 of NPC 250-1.	10					
10.3	Equipment log entries are complete and unambiguous.	3					
10.4	Equipment logs include: <ul style="list-style-type: none"> <li>a. Data and time of entry.</li> <li>b. Identity of test or inspection.</li> <li>c. Environmental conditions.</li> <li>d. Characteristics being investigated.</li> <li>e. Parameter measurements.</li> <li>f. Complete identification of instrumentation used including serial number and calibration data.</li> <li>g. Failure observation and failure report reference.</li> <li>h. Accumulated operating time.</li> <li>i. Cumulative number of duty cycles to date.</li> <li>j. Deviation from specifications or drawings.</li> <li>k. Repair and maintenance record.</li> <li>l. Record of pertinent unusual occurrences involving the equipment.</li> <li>m. Action taken to have "quick fixes" in test formalized as design changes.</li> </ul>	7					
10.5	The format for the equipment logs is approved by the cognizant NASA installation as part of the Reliability Program Plan.	5					
10.6	Equipment logs are available for inspection and review.	3					

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 11.0 RELIABILITY EVALUATION		A.	B.	C.	D.	E.
WORK ELEMENTS						
	<u>Reliability Evaluation Plan</u>					
11.1	A comprehensive integrated test program and reliability evaluation plan is prepared and maintained current.	7				
	Doc. No. _____ Title _____ Date _____					
11.2	The contractor's reliability evaluation plan includes subcontractor plans.	5				
11.3	The reliability evaluation plan includes testing schedules, assessment schedules and facility requirements.	5				
11.4	The reliability evaluation plan describes the purpose of each test.	3				
11.5	The reliability evaluation plan specifies procedures to assure that replacement parts possess as high inherent reliability as the original parts.	5				
	<u>Testing</u>					
11.6	A detailed plan is proposed for each test in the reliability evaluation program.	7				
	Doc. No. _____ Title _____ Date _____					
11.7	The reliability organization has responsibility to assure that statistical test planning is adequate.	7				
11.8	There is a time-phased test plan for qualification testing, reliability acceptance and design performance acceptance testing.	10				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 11.0 RELIABILITY EVALUATION		A.	B.	C.	D.	E.
WORK ELEMENTS						
11.9	Test specifications and test procedures are prepared separately for each test in the testing program.	7				
	Doc. No. _____ Title _____ Date _____					
11.10	Reliability acceptance specifications including confidence limits are prepared.	7				
11.11	Tests are devised to isolate failed parts in equipment at the lowest possible level of assembly.	5				
11.12	Variables data are recorded for functional parameters proposed by the contractor and approved by NASA or its designated representative.	5				
11.13	Test evaluations data are required to be complete and to include type of test, stress conditions, operating time, and unsatisfactory conditions.	7				
	Doc. No. _____ Title _____ Date _____					
	<u>Test Equipment</u>					
11.14	Calibration procedures include requirements for recalibration schedules for test equipment.	5				
	Doc. No. _____ Title _____ Date _____					
11.15	Theoretical test equipment evaluations are considered throughout the design phase and especially prior to the release of the design.	7				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 12.0 DOCUMENTATION OF RELIABILITY PROGRAM		A.	B.	C.	D.	E.
WORK ELEMENTS						
12.1	<u>Management Review and Approval</u> The Reliability Program Plan is published, is maintained up to date, and includes procedures and methods of program implementation. Doc. No. _____ Title _____ Date _____	7				
12.2	The initial Reliability Program Plan and all revisions thereto are submitted to the cognizant agency for approval and review prior to implementation. Doc. No. _____ Title _____ Date _____	7				
12.3	Provisions for reliability control of subcontractors and suppliers are included in the submission of the Program Plan. Doc. No. _____ Title _____ Date _____	5				
12.4	As subcontractors and suppliers of additional components (above the part level) are selected subsequent to the initial submission of the Reliability Program Plan, system components to be provided, names of contractors and provisions for their reliability control are submitted in periodic reports to the cognizant agency. Doc. No. _____ Title _____ Date _____	1				
12.5	The Reliability Program Plan is formally reviewed at appropriate major milestones and reports are submitted to the cognizant agency within 30 days following review. Doc. No. _____ Title _____ Date _____	5				
12.6	The Reliability Evaluation Plan is reviewed at milestones as specified in the plan, and reports are submitted to the cognizant agency within 30 days following the review. Doc. No. _____ Title _____ Date _____	3				
12.7	Reports of parts and materials application reviews are submitted to the cognizant agency within 30 days following the review. Doc. No. _____ Title _____ Date _____	3				

# RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Estab. Rel. Imp. Fac. (1-10)				
ACTIVITY AREA: 12.0 DOCUMENTATION OF RELIABILITY PROGRAM		A.	B.	C.	D.	E.
WORK ELEMENTS						
12.8	Reports of design reviews are submitted to the cognizant agency within 21 days following the review.  Doc. No. _____ Title _____ Date _____  <u>Management Reports Documentation</u> Weekly reports are prepared as prescribed by the contracting agency or cognizant NASA installation. Monthly progress reports are prepared as prescribed by the contracting agency or cognizant NASA installation. Monthly financial reports are prepared as prescribed by the contracting agency or cognizant NASA installation. Quarterly progress reports are prepared as prescribed by the contracting agency or cognizant NASA installation. Other periodic and non-periodic reliability reports are furnished as required.	5				
12.9		5				
12.10		5				
12.11		5				
12.12		5				
12.13		5				
12.14	<u>General Technical Documentation</u> Contractor maintains up to date, as part of prescribed reports, or as separate submissions: <ul style="list-style-type: none"> <li>a. Reliability block diagrams.</li> <li>b. Design specifications.</li> <li>c. Failure mode, effect and criticality analysis.</li> <li>d. Reliability prediction and assessment models.</li> <li>e. Human engineering and maintainability progress reports.</li> <li>f. Failure summary and corrective action reports.</li> </ul>	5				

## RELIABILITY PROGRAM EVALUATION

CENTER _____ CONTRACTOR _____ NO. _____ DATE _____		Function Resp. for Work El. Rel. Need (A - C) Weighted Eff. Coverage (A X B) Degree of Eff. Coverage (%) Etab. Rel. Imp. Fac. (1-10)					A.	B.	C.	D.	E.
ACTIVITY AREA: 12.0 DOCUMENTATION OF RELIABILITY PROGRAM											
WORK ELEMENTS											
12.14	g. Parts application and selection progress reports. h. Parts and materials specification. i. Parts and materials qualification status lists. j. Parts and materials qualification test specifications. k. Approved parts and material lists. l. Test, specifications, procedures and reports. m. Reliability apportionment diagrams.										